

Remarks

Claims 1-20 are pending in the present application.

Claims 1-20 stand rejected under 35 USC § 101 as not being directed to a practical application by physical transformation.

Claims 14-20 stand rejected under 35 U.S.C. § 112, second paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 1-4, 6-11, 13-17, 19 and 20 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Molyneaux (US 5,394,087).

Claims 5, 12, and 18 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Molyneaux in view of Boskamp *et al.* (US 6,639,406).

Claims 1-20 remain in the application unamended.

The § 101 Rejection

In making the § 101 rejection, the Office Action states that the claims are not directed to a practical application by physical transformation. The Office Action thus concludes that the invention, as claimed does not produce a useful, concrete and tangible result. The Office Action goes on to state that the claims suggest only a combination of instructions to combine signals received by the first and second loops in a quadrature mode and not using any structure to provide a useful, concrete and tangible end result.

Claim 1 is directed to a magnetic resonance imaging apparatus comprising: a main magnet for generating a main magnetic field in an examination region ; a plurality of gradient coils for setting up magnetic field gradients in the main field; an RF transmit coil for transmitting RF signals into the examination region to excite magnetic resonance in a subject disposed therein; an RF receive coil for receiving RF signals from the subject, the RF receive coil including a first loop and a second loop, the first and second loops being disposed substantially in a similar plane; and a signal combiner for combining the signals received by the first and second loops in a quadrature mode.

It is respectfully submitted that combining the signals received by the first and second loops in a quadrature mode provides a useful end result. As one skilled in the art will appreciate, a quadrature coil, which has a circularly polarized magnetic field,

receives orthogonal components of a rotating vector. A quadrature coil can support both the horizontal and vertical magnetic current distributions. Thus, the quadrature coil extracts twice the signal from the rotating vector than does the linearly polarized coil. This results in a signal-to-noise ratio which is greater by the square root of two or about 41%. See the present application at page 1, lines 12-16. Clearly, combining signals in a quadrature mode as set forth in claim 1 results in a useful result.

Claim 8 is directed to a magnetic resonance imaging apparatus comprising: a main magnet for generating a main magnetic field in an examination region; an RF transmit coil positioned about the examination region such that it excites magnetic resonance in dipoles disposed therein; an RF transmitter for driving the RF transmit coil; an RF receive coil for receiving magnetic resonance signals from the resonating dipoles, the RF receive coil including a plurality of loop coils, the plurality of loop coils being disposed in non-orthogonal planes with respect to one another; and a signal combiner for combining the signals received by the plurality of loop coils selectively in a quadrature combination mode or a phased array mode.

The foregoing discussion with respect to claim 1 can be applied analogously to claim 8.

Claim 14 is directed to a magnetic resonance RF coil assembly comprising: a first loop, the first loop being disposed in a first plane; a second loop, the second loop being disposed in a second plane; the first and second planes being non-orthogonal; and a signal combiner for quadrature combining RF signals associated with the first loop with RF signals associated with the second loop.

The foregoing discussion with respect to claim 1 can be applied analogously to claim 14.

In light of the above, Applicants respectfully request reconsideration and withdrawal of the rejection of claims 1-20 under 35 USC § 101.

The § 112 Rejection

Claims 14-20 stand rejected as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The

Office Action states that the phrase “the first loop coil with RF signals associated with the second loop” does not recite the proper structure required by the claimed invention.

Claim 14 is directed to a magnetic resonance RF coil assembly comprising: a first loop, the first loop being disposed in a first plane; a second loop, the second loop being disposed in a second plane; the first and second planes being non-orthogonal; and a signal combiner for quadrature combining RF signals associated with the first loop with RF signals associated with the second loop.

Applicants respectfully submit that it appears as though the entire claim limitation in question has not been examined. As set forth in claim 14, the magnetic resonance RF coil assembly includes . . . a signal combiner for quadrature combining RF signals associated with the first loop with RF signals associated with the second loop. Support for such a limitation can be found by way of example at page 10, lines 2-6. Accordingly, claims 14-20 are not indefinite. Applicants request reconsideration and withdrawal of the rejection under § 112.

The § 102 Rejection

Claims 1-4, 6-11, 13-17, 19 and 20 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Molyneaux (US 5,394,087).

Claim 1 is directed to a magnetic resonance imaging apparatus comprising: a main magnet for generating a main magnetic field in an examination region ; a plurality of gradient coils for setting up magnetic field gradients in the main field; an RF transmit coil for transmitting RF signals into the examination region to excite magnetic resonance in a subject disposed therein; an RF receive coil for receiving RF signals from the subject, the RF receive coil including a first loop and a second loop, the first and second loops being disposed substantially in a similar plane; and a signal combiner for combining the signals received by the first and second loops in a quadrature mode.

It should be noted that the Office Action has not particularly identified how each of the claimed elements are anticipated by Molyneaux. However, in order to facilitate the prosecution of the claims going forward, Applicants will respectfully address the subject rejection in detail.

It is submitted that Molyneaux does not teach or suggest all of the limitations of claim 1. Molyneaux teaches with reference to FIG. 2, that the quadrature multi-coil array 30 includes two quadrature coil pairs which are sensitive to signal components orthogonal to the plane of the coils, e.g. square loop coils. The quadrature pairs further include 54.sub.1, 54.sub.2 which are sensitive to electromagnetic signal components parallel to the plane of the coil, e.g. flattened Helmholtz coils or double loop coils. The perpendicular component sensitive coils and the parallel component sensitive coils are mounted to have substantially the same fields of view. The coils have an overlap region 56 orthogonal to the z-axis in which the four coils are partially overlapping. Preferably, the perpendicular component sensitive coils 52 and the parallel component sensitive coils 54 are mounted on opposite faces of a thin dielectric substrate 58. See, Molyneaux, column 3, line 64 – column 4, line 10. In short, Molyneaux teaches that each quadrature coil pair 50 includes a first coil 52 which is sensitive to perpendicular signal components and second coil 54 which can be a flattened Helmholtz coil or double loop coil (i.e. a non-loop coil) which is sensitive to the parallel components. Accordingly, Molyneux does not teach or suggest the RF receive coil including a first loop and a second loop, the first and second loops being disposed substantially in a similar plane; and a signal combiner for combining the signals received by the first and second loops in a quadrature mode as set forth in claim 1.

In light of the foregoing, reconsideration and withdrawal of the rejection under § 102 of claim 1 is respectfully requested.

Claims 2-7 depend from claim 1. For at least the reasons set forth above in connection with claim 1, reconsideration and withdrawal of the rejections of claims 2-7 are respectfully requested.

Claim 8 is directed to a magnetic resonance imaging apparatus comprising: a main magnet for generating a main magnetic field in an examination region; an RF transmit coil positioned about the examination region such that it excites magnetic resonance in dipoles disposed therein; an RF transmitter for driving the RF transmit coil; an RF receive coil for receiving magnetic resonance signals from the resonating dipoles, the RF receive coil including a plurality of loop coils, the plurality of loop coils being disposed in non-orthogonal planes with respect to one another; and a signal combiner for

combining the signals received by the plurality of loop coils selectively in a quadrature combination mode or a phased array mode.

The foregoing discussion with respect to claim 1 can be applied analogously to claim 8. Reconsideration and withdrawal of the rejection under § 102 of claim 8 are respectfully requested.

Claims 9-13 depend from claim 8. For at least the reasons set forth above in connection with claim 8, reconsideration and withdrawal of the rejections of claims 9-13 are respectfully requested.

Claim 14 is directed to a magnetic resonance RF coil assembly comprising: a first loop, the first loop being disposed in a first plane; a second loop, the second loop being disposed in a second plane; the first and second planes being non-orthogonal; and a signal combiner for quadrature combining RF signals associated with the first loop with RF signals associated with the second loop.

The foregoing discussion with respect to claim 1 can be applied analogously to claim 14. Reconsideration and withdrawal of the rejection under § 102 of claim 14 are respectfully requested.

Claims 15-20 depend from claim 14. For at least the reasons set forth above in connection with claim 14, reconsideration and withdrawal of the rejections of claims 15-20 are respectfully requested.

The § 103 Rejection

Claims 5, 12, and 18 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Molyneaux in view of Boskamp *et al.* (US 6,639,406).

Claims 5, 12, and 18 ultimately depend from claims 1, 8 and 14 respectively. For at least the reasons set forth above in connection with their base claims, reconsideration and withdrawal of the rejections of claims 5, 12 and 18 are respectfully requested.

Conclusion

Applicants submit that claims 1-20 distinguish patentably and non-obviously over the prior art of record and are in condition for allowance. An early indication of allowability is earnestly solicited.

If any extension of time is required relative to this Response A, Applicants hereby petition for such extension. Authorization to charge deposit account 14-1270 for the fees associated therewith or otherwise necessary in connection with the related application is hereby provided.

Respectfully submitted,



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